



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/786,409	02/25/2004	Eric Bouillon	BDL-450XX	3997
207	7590	09/01/2006	EXAMINER	
WEINGARTEN, SCHURGIN, GAGNEBIN & LEOVICI LLP TEN POST OFFICE SQUARE BOSTON, MA 02109			AFTERGUT, JEFF H	
			ART UNIT	PAPER NUMBER

1733

DATE MAILED: 09/01/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/786,409

Applicant(s)

BOUILLON ET AL.

Examiner

Jeff H. Aftergut

Art Unit

1733

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on ____.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-16 is/are pending in the application.
- 4a) Of the above claim(s) ____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) ____ is/are allowed.
- 6) ☒ Claim(s) 1-16 is/are rejected.
- 7) ☐ Claim(s) ____ is/are objected to.
- 8) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on ____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. ____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. ____. |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date <u>10-22-04, 2-25-04</u> . | 6) <input type="checkbox"/> Other: ____. |

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. Claims 1, 2, 4-6 and 8-16 are rejected under 35 U.S.C. 103(a) as being unpatentable over the admitted prior art in view of U.K. 2,323,056 optionally further taken with Jarmon et al.

The admitted prior art suggested that it was common to provide a ceramic matrix composite which included the steps of preparing a fiber perform that is to constitute the reinforcement of the composite part and densifying the perform with a ceramic matrix possibly after forming an interphase layer on the fibers of the perform. Densification can be performed by a liquid method by impregnation of the perform with a liquid composition containing a precursor for the ceramic material of the matrix. Densification can also take place by a gas method, i.e. chemical vapor infiltration using a reaction gas containing one or more precursors for the ceramic matrix. These methods were stated to be well known in the manufacture of a ceramic matrix composite. The applicant additionally suggested that it would have been desirable to form the walls of gas turbine combustion chambers from ceramic matrix composites. In the past a large number of perforations were provided in the wall of the ceramic matrix composite. In the past these openings were formed via a laser drilling operation. For wall of the gas turbine combustion chambers formed from metal alloys, the laser drilling operation was

Art Unit: 1733

acceptable, however for wall of the chamber formed from ceramic matrix composites the laser drilling operation resulted in destruction of the reinforcing fibers in the assembly of the composite which weakened the mechanical strength of the composite. The admitted prior art failed to teach that one skilled in the art was aware of the specified inclusion and removal of pins in the formation of the perforations in the composite material wherein one could eliminate breakage of the fiber material of the perform.

U.K. '056 suggested that it was known at the time the invention was made to form a plurality of holes (perforations) in a composite panel by a process wherein a fiber perform was formed and contained a partially cured resin therein. The process included deposition of a plurality of pins 13 into the partially cured composite perform 12. Following insertion of the pins 13, the reference suggested that those skilled in the art would have inserted the pins from a foam material disposed on the perform and containing the pins therein. The reference taught that after the resin of the perform was cured, the pins were removed via an elimination operation which did not impact the cured composite material (i.e. chemical etching). The reference to U.K. '056 suggested that in the prior art it was known at the time the invention was made to form holes in a composite material via a drilling operation, however such was undesirable because it led to breaking (cutting) of the fibers and exposure of the same. The applicant is referred to pages 1-2 the paragraph bridging these pages. The reference clearly suggested that in a composite material which included a matrix and reinforcing fibers it was desirable to form holes (perforations) therein by a process wherein pins were

Art Unit: 1733

inserted into the perform of composite material which included resin in a partially cured state followed by curing of the resin to a C-stage and removal of the pins by etching to provide holes in the composite material without damaging the reinforcing fibers therein. While it is recognized that U.K. '056 is not directed to a matrix material which is ceramic, the formation and use of a ceramic matrix was well known in the art and the problem of formation of perforations in a composite material (breaking and exposure of the fibrous reinforcement of the composite material) was the same regardless of the matrix material utilized. It would have been obvious to one of ordinary skill in the art at the time the invention was made to employ the techniques of U.K. 2323056 to facilitate the formation of holes in a ceramic matrix composite material whereby the openings in the composite were formed without damaging the reinforcing fibers therein which would have reduced the mechanical strength of the finished assembly.

With regard to claim 2, note that the reference to U.K. '056 suggested complete removal of the pins. With regard to claims 4 and 5, one skilled in the art would have readily appreciated that for a ceramic composite a suitable means to remove the pins would have been via oxidation and additionally the use of carbon fibers in a matrix would have been suitable for removal via oxidation. Regarding claim 6, note that the reference to U.K. '056 suggested that those skilled in the art would have incorporated ultrasonics to press the foam material to insert the pins in the perform, see page 4, lines 21-27. Regarding claim 8 and 9, note that the art was replete with formation of ceramic matrix composites wherein the matrix materials were ceramic matrix phase materials or carbon matrix phase materials and such is taken as conventional in the art.

Art Unit: 1733

Regarding claims 10 and 11, the specified volume ratio of the pores would have been a function of the article being manufactured and the desired cooling efficiency of the same and would have been determined through routine experimentation (as to the number of pins inserted into the preform for example). Regarding claim 12, note that self healing ceramics were known per se in the art and taken as conventional for their use in formation of a ceramic matrix composite. Regarding claim 13, note that the admitted prior art suggested the formation of the specified gas turbine combustion chamber. Regarding claims 14-16, the form that the perform takes is well known and a function of the desired strength and reinforcement employed in the composite article.

While it is believed that the references as set forth above suggested that those skilled in the art would have performed the operation of perforating with pins which were inserted into a perform wherein one was forming a ceramic matrix composite material for provision of cooling holes therein, the reference to Jarmon et al is cited as further evidence that those skilled in the art at the time the invention was made would have known to perform an oxidation operation to remove carbon fiber rods in a matrix in the formation of a cooling opening of a ceramic matrix composite material. More specifically Jarmon et al suggested that rods of resin impregnated carbon fibers would have been useful as fugitive materials in a ceramic matrix composite for the formation of cooling holes therein. As it would have facilitated the formation of openings for cooling passages in a ceramic matrix composite, it would have been obvious to one of ordinary skill in the art to employ fugitive pins such as those suggested by Jarmon et al as the pins which were inserted into a perform prior to ceramic infiltration in U.K. 2323056

Art Unit: 1733

when making a ceramic matrix composite having perforations therein useful as cooling passages for a gas turbine as suggested by the applicant's admitted prior art.

With specific reference to claims 4 and 5, note that Jarmon specifically suggested that those skilled in the art would have formed the pins from material which was oxidized to remove the same wherein the pins were made of carbon fibers in an epoxy matrix for example.

3. Claim 3 is rejected under 35 U.S.C. 103(a) as being unpatentable over the references as set forth above in paragraph 2 further taken with Hegedus.

While the references as set forth above in paragraph 2 provided for the inclusion of pins which were removed via oxidation, there is no indication that one skilled in the art of ceramic matrix composites would have coated the exterior of the pins with a ceramic material which was retained in the finished assembly wherein the coating was provided about a core of carbon material. However, in the manufacture of ceramic composites, it was well known at the time the invention was made to control the porosity of the same via an operation where the ceramic was provided with a carbon fiber material which was subsequently oxidized. The reference to Hegedus suggested that those skilled in the art would have formed the fugitive fibers therein from carbon fibers which were oxidized out wherein the fiber assemblies which are removed via the oxidation operation were formed by coating the fibers with a thermosetting matrix material and then coating the fibers with a ceramic precursor material about the exterior of the coated fibers. The artisan would have understood that such a coating of the carbon fibers which form the core would have been a suitable manner for forming the

Art Unit: 1733

same and would have desired to employ conventional fugitive fiber arrangements in the process of paragraph 2 above. It would have been obvious to one of ordinary skill in the art at the time the invention was made to utilize the techniques of Hegedus to form the carbon fugitive fibers in preparation for making a porous (perforated) ceramic matrix composite in the process in accordance with the references as set forth above in paragraph 2 as the use of the conventional carbon core and exterior ceramic precursor material about the exterior would have ensured that the subsequently formed openings would have been lined with the ceramic material and free of openings therein (from excess carbon which was removed).

4. Claims 6 and 7 are rejected under 35 U.S.C. 103(a) as being unpatentable over the references as set forth above in paragraph 2 further taken with PCT WO 97/06948 and Freitas et al.

While the reference to U.K. '056 suggested that those skilled in the art at the time the invention was made would have included the step of providing an ultrasonic device to press the pins into the perform, to further evidence that such a technique was well known for pin insertion into a preform, the reference to PCT '948 is cited. The reference made it clear that those skilled in the art at the time the invention was made would have understood how to insert pins into a perform wherein an ultrasonic tool was used to press the pins into the composite perform material. Clearly, when the reference to U.K. '056 suggested that one press with an ultrasonic tool, it was suggestive of the ultrasonic tooling envisioned by PCT '948. The references failed to expressly suggest that the pins would have been placed into the composite material angle, however it should be noted

that when U.K. '056 placed the perform on a curved surface the pins were inserted therein at an angle. One skilled in the art would have understood from Jarmon et al (see Figure 5 for example) that angular placement was desirable for cooling gas ports for a gas turbine. The reference to Freitas suggested that those skilled in the art at the time the invention was made would have known how to insert the pins into the perform material at an angle and additionally one is advised that such was merely a function of the desired location of the perforations in the finished assembly one wanted (and as suggested by Jarmon et al one skilled in the art would have understood that placement at an angle would have been desirable). It would have been obvious to one of ordinary skill in the art at the time the invention was made to employ the techniques of Freitas to insert pins at an angle to the surface being treated (as such was known for perforations to provide cooling gas for a gas turbine) wherein the same was performed by ultrasonics as suggested by PCT WO 97/06948 in the process of making perforations in a ceramic matrix composite material for a gas turbine as taught above in paragraph 2.

Claim Rejections - 35 USC § 112

5. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

6. Claims 1-16 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

In claim 1, lines 2-3, the phrase “comprising the steps consisting in” appears as the transition phrase between the preamble and the remainder of the claim. It is not

Art Unit: 1733

clear whether applicant intends the claims to be viewed as open (comprising) or closed (consisting of). It should be noted that for purposes of examination it has been assumed that applicant intended the claim to be open claim language. It is suggested that that the above noted language be changed to --comprising the steps of--. In claim 1, lines 4-5, the language "the fiber reinforcement" appears which lacks proper antecedent basis because no fiber reinforcement has been previously defined. It is suggested that "the" be deleted on line 4 of the claim. In claim 1, line 7, the language "the fibers" appears which lacks proper antecedent basis because no "fibers" have been previously defined. It is suggested that "the" be deleted. In claim 1, line 11, the language "continuing densification of the consolidated perform" appears, however there is no step previously defined for densification of the perform. It is suggested that applicant clearly define an initial step of densification of the perform and halting of the same prior to the language "continuing densification". Alternatively, applicant could delete the language "continuing densification of" and replace it with --densifying--. In claim 1, lines 17-18, the language "the ceramic material of the matrix" lacks proper antecedent basis as no "ceramic material" has been clearly defined. It is suggested that applicant provide proper antecedent basis for the same.

In claim 7, line 3, it is suggested that "the normal" be changed to --a normal-- to provide proper antecedent basis for the same. Additionally on line 3 of claim 7, "the surface" should be changed to --a surface-- to provide proper antecedent basis for the same.

In claim 10, line 2, "the volume ratio" lacks proper antecedent basis. It is suggested that "the" be changed to --a--. In claim 10, line 2, "the pores" lacks proper antecedent basis as no "pores" have been previously defined. It is suggested that "the" be deleted.

In claim 11, line 2, "the volume ratio" lacks proper antecedent basis. It is suggested that "the" be changed to --a--. In claim 11, line 2, "the pores" lacks proper antecedent basis as no "pores" have been previously defined. It is suggested that "the" be deleted. In claim 11, line 3, "the range" appears which lacks proper antecedent basis. It is suggested that "the" be changed to --a--.

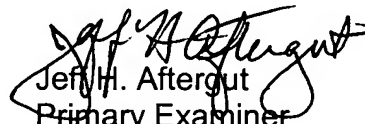
Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jeff H. Aftergut whose telephone number is 571-272-1212. The examiner can normally be reached on Monday-Friday 7:15-345 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Richard Crispino can be reached on 571-272-1226. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Art Unit: 1733

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.


Jeff H. Aftergut
Primary Examiner
Art Unit 1733

JHA
August 30, 2006